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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/662,809	09/16/2003	Seiji Nagai	T36-159069M/KOH	1114

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VIENNA, VA 22182-3817

EXAMINER
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RAO, G NAGESH

ART UNIT	PAPER NUMBER
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1792

MAIL DATE	DELIVERY MODE
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11/06/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/662,809

Applicant(s)

NAGAI ET AL.

Examiner

G. Nagesh Rao

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6-15 and 17-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6-15 and 17-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

***Continued Examination Under 37 CFR 1.114***

1) A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/15/07 has been entered.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
- 2) Claims 1, 3-4, 6-15, and 17-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tischler (US Pg Pub 2002/0028314) in view of Shibata (US Patent No. 6,824,610).

Tischler 314 pertains to a process for producing Gallium-Nitride (GaN) semiconductor substrates with multiple layers via a variety of various methods in examples disclosed in the specification furthermore note that Tischler 314 refers to the GaN layer as a metal nitride (M\*N) however that is understood by the examiner to be a synonym for a Group III-V nitride material (See Sections 0002-0013). Tischler 314 in specific embodiments teaches a sacrificial silicon substrate having been etched away via HCl while the substrate/M\*N structure is preferably maintained, the etching occurs on the rear portion of the Si substrate (See Fig. 4). Tischler 314 also teaches that introduction of HCl is passed over the Gallium to transport it into the reactor in the form of "Gallium Chloride" which applicant attributed in the remarks as being the Halide Agent to utilize in the reactor (See Sections 0014-0019 and 0050-0051).

The M\*N layer for example GaN may be deposited directly on the surface of the crystalline or non-crystalline substrate, or alternatively it may be deposited on an upper most surface of one or more intermediate layers which in turn are

deposited on the crystalline substrate. The one or more intermediate layers may serve as a buffer layer to enhance the crystallinity of the M\*N layer, as a template for the subsequent M\*N growth thereon, or the intermediate layer(s) may serve as protective layer(s) or as an etch stop to prevent the etchant for the sacrificial substrate from etching into the M\*N material (See Section 0020-0021) but thereby denoting that the etch could occur from the rear portion of the sacrificial substrate since the intermediate buffer layers are followed by the substrate before the top layer of M\*N is completely processed. As well the M\*N layer could contain more aluminum in the Group III nitride compound in the event the layer is decidedly an AlN layer or a AlGaN or AlGaInN layer and whereby the thickness layers for first, second, and subsequent levels thereafter maintain a thickness range from 1-100 microns thick (See Sections 0092-0093).

The growth of the M\*N layer material may be carried out in a HVPE reactor whereby although denoted as a hydride vapor phase epitaxy reactor, examiner qualifies this as an equivalent and capable of handling applicant's claim of a halide vapor phase epitaxy. Upon reviewing applicant's specification, examiner noted the reference of HVPE as being a halide based reactor due to the use of HCl and GaCl (applicant's specification and remarks) as either the gaseous etchant (HCl) or source material for growing the nitride semiconductor film (GaCl). Although

Tischler 314 denotes HVPE differently, it does disclose the use of HCl and GaCl as either the gaseous etchant or source material (GaCl see Section 0051) for creating the free standing M\*N semiconductor substrate.

Furthermore Tischler 314 teaches processing parameters for the HVPE method have temperatures growth for a GaN layer be between 1000-1200<sup>0</sup>C and the desired thickness range be between 1-1000 microns but preferably at 100-300 microns thus reading on claimed thickness and temperature variations as claimed by applicant (See Section 0050 and 0025) as well the ability to grow more than one layer of M\*N materials as suggested by the language of section 0051. However as noted in that preferred embodiment the process begins with a "...growth temperature (in the range of 800-1300<sup>0</sup>C) and introducing the growth precursors for GaN formation...", therefore covering said 800-900<sup>0</sup>C range claimed by applicant.

Finally Tischler 314 teaches an ability to prevent lattice mismatch dislocation in particular preventing dislocations i.e. warping of the M\*N substrate material which is in turn a form of a Group III nitride compound (See Section 0040). This and the fact that the methodology of creating said substrate will have the rear surface of said silicon substrate opposing the surface on which said group III nitride compound semiconductor layer is formed. Also Examiner invites

applicant's to review Sections 0064-0094) for further details and information on various and alternative embodiments disclosed in the reference that teach processing parameters related to the growth and production of this Group III nitride semiconductor compound.

Examiner has denoted from applicant's remarks and currently claimed invention that Tischler 314 does not outright explicitly teach the first layer of the metal-nitride semiconductor being processed at a temperature of 800-900<sup>0</sup>C and the second layer of metal-nitride material (i.e. Group III in particular) manufactured at a temperature of not lower than 1000<sup>0</sup>C.

However Tischler 314 does teach that the compound semiconductor is manufactured in the range of 800-1300<sup>0</sup>C denoting that it would be conceivable to one having ordinary skill in the art at the time of the invention via routine experimentation to produce the structure at a variety of temperature levels and ranges depending on the state of the layer manufacture for the compound semiconductor device. There is nothing precluding in this reference or applicant's remarks that would suggest one having ordinary skill in the art at the time of the invention would not understand or conceive of the process as claimed by applicant. The teachings are there and obvious to modify to meet the parameters claimed by the applicant.

As fulfilling the request by applicant regarding the aforementioned Tischler 314 pertains to a method of forming bulk-single crystal GaN material. Tischler 314 for the most part teaches or obviates the claimed parameters by applicant for the HVPE manufacturing of the GaN material. However applicant's requested examiner put forth evidence that would suggest said parameters as being obvious to one having ordinary skill in the art at the time of the present invention.

Essentially the original and new claim limitation regarding the second temperature of the second Group III nitride layer put down after the first layer and its concurrent temperature is put down being lower than second temperature. In essence an increase in the temperature occurs during subsequent layering of the nitride layers.

In analogous art to the Tischler 314 reference, Shibata 610 pertains to the process for fabricating GaN crystal compounds and provides evidence of varying temperatures that are higher than the original temperature of the first layer. Furthermore teaching the removal of the substrate layer and pressing upon these as well known processing parameters with furthermore similar thickness and temperature processing conditions for the nitride layers deposited on the substrate (see Col 1 Lines 36-44, Col 3 Lines 20-25, Cols 7-14 Lines 1-68, in particular Examples 9-11 and 13).



It would therefore be obvious to one having ordinary skill in the art at the time of the present invention to incorporate the teachings of Shibata 610 into that of Tickler 314 in order to showcase and highlight further various well known processing techniques in fabricating the Gann structures and in particular render that from the known teachings of Tickler 314 that it is obvious from the basic processing parameters to further develop various ways of growing the structures as highlighted by the multiple examples showcased in Shibata 610.

### *Response to Arguments*

3) Applicant's arguments filed 10/15/07 have been fully considered but they are not persuasive. Examiner notes the following below.

Examiner has noted the remarks and additional dependent claims but upon further review of the reference Tischler 314 still teaches or obviates the prescribed elements, ranges, and process claimed by applicant. The narrowed temperature range as processing parameters claimed by applicant still falls within scope of what is taught by Tischler 314 as noted in the rejection above. Furthermore as requested by applicant, examiner put forth a secondary reference to highlight and further stress upon the basic obviousness of said claim limitations being capably met by the teachings of Tischler 314 with that of Shibata 610 and therefore in essence

completing applicant's request of fulfilling the official notice examiner put forth on the method claims at hand.

Tischler 314 along with Shibata 610 teaches every prescribed limitation in of itself or with further referencing guidance with the secondary reference put forth to further obviate the current claim limitations.

Applicant's contend that Tischler 314 did not teach the first metal nitride layer at 800-900<sup>0</sup>C and the second nitride layer at no lower than 1000<sup>0</sup>C. As to which they continue to argue in the remarks the deficiencies of Tischler 314 which examiner agreed with applicant from the remarks of 3/13/07. However examiner did put forth the Shibata 610 reference to remedy the "quasi official notice" that was put forth. The bulk of arguments filed 7/2/07 and 10/15/07 pertain to the office action filed on 12/15/06, 4/2/07, and 7/2/07.

Applicant's argue that Shibata 610 would apparently destroy the teachings of Tischler 314, which an inaccurate depiction. Both references are analogous to the state of technology pertaining to metal nitride layers, as well GaN and AlN are both substitutionally equivalent materials as one having ordinary skill in the art would recognize the mutual benefits of combining both inventive teachings and obviate applicant's claimed invention.

Applicant's are contending a specified temperature range with respect to their applied nitride layers, Tischler 314 provided a great hunch, but in the fairness of the situation it could not stand alone as a 102 rejection and apparently to applicants not as a single 103 rejection. Thus examiner offered Shibata 610 which by the way does offer alternative choices for the nitride layers (not just AlN layering only) and the title for Shibata 610 is "Process for Producing Gallium Nitride Crystal Substrate and Gallium Nitride Crystal Substrate" whereas Tischler 314's title is "Bulk Single Crystal Gallium Nitride and Method of Making Same". The titles along suggest an analogous state of art and when reading the specifications of both references, one having ordinary skill in the art would conceivably find them to be correlating references to combine especially due to their in depth discussion of growing metal nitride layers, or why else would examiner not use Tischler 314 as a primary reference, and most certainly applicant's contention that Shibata 610 and Tischler 314 are not combinable is off point.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413,

208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In conclusion, applicant's remarks that Tischler 314 and Shibata 610 is not combinable art is respectfully disagreed with, because they indeed pertain to processes for Gallium Nitride semiconductor compound crystal structures and the fact the reference does not mention the word "semiconductor" is moot, because it is inherent from the teachings that these references refer to "semiconductor" compounds. From the fact that the prior art pertains to microelectronic based devices, like LED's and whatnot, as well the very definition of the term "semiconductor" which denotes a material with partial conductive properties, in

this case Gallium Nitride, where the gallium “conductive element” is doped down via the “non-conductive element” being the nitride.

Applicants’ arguments cannot take the place of evidence lacking on the record. There is no evidence on the record to rebut the obviousness rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to G. Nagesh Rao whose telephone number is (571) 272-2946. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Michael Barr can be reached on (571)272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GNR

*/Robert Kunemund/  
Robert Kunemund  
Primary Examiner  
TC 1700*